Standard 5-3: The student will demonstrate an understanding of major domestic and foreign developments that contributed to the United States' becoming a world power.

5-3.2 Identify prominent inventors and scientists of the period and summarize their inventions or discoveries, including Thomas Edison, Alexander Graham Bell, the Wright Brothers, and Albert Einstein. (H)

Taxonomy Level: B 2 Understand /Conceptual Knowledge

Previous/future knowledge:
This is the first and only time that these specific inventors are mentioned in the standards.

It is essential for students to know:
Inventors and scientists contributed to the Industrial Revolution in the United States and helped the US to become a leading industrial and military power in the world. Scientists also served as entrepreneurs, developing their inventions into businesses that stimulated the growth of the American economy.

Thomas Edison was not only an inventor but also an entrepreneur who established a commercial laboratory at Menlo Park, New Jersey. There he led a team of scientists who were funded by investors in a quest for a variety of inventions. The inventions developed at Menlo Park included the incandescent light bulb and the phonograph. Once the light bulb was perfected, Edison had to develop an entire electrical system to make the light bulb practical and to showcase its potential. He built a power generating station in New York City that provided the power to light office buildings and started a company to provide electricity to the city [1882]. Other cities also built power stations and soon many businesses used the electric light. This changed the work habits of many Americans who could now work longer hours. Eventually homes were also lit by the incandescent light bulb and labor saving devices were powered by electricity. However it was many years before electricity reached Americans in rural areas. Edison's invention eventually led to the creation of the General Electric Corporation [early 1890s].

Alexander Graham Bell developed his invention of the telephone into a major corporation, Bell Telephone Company, that later became American Telephone and Telegraph. ATT eventually provided telephone services to people throughout the United States. Bell also founded a laboratory where he worked with other scientists to develop new inventions.

The **Wright Brothers** (Orville and Wilbur) started the aircraft industry with their experiments in manned flight. They experimented with a flying machine for several years before their motorized airplane flew for 12 seconds at Kitty Hawk, North Carolina [in 1903].

Albert Einstein was not an inventor but a physicist who made significant contributions to the world of science and to the emergence of the United States as a world power. Einstein is best known for the theory of relativity [1915]. His contributions were made during the first half of the 20th century, not during the same time as Edison and Bell. Einstein's contributions might best be taught in the context of the world wars. Because he was Jewish, Einstein fled Germany in 1933 and came to the United States. He was instrumental in convincing President Roosevelt to establish the Manhattan Project, which developed the atomic bomb. Although the development of the atomic bomb was based on Einstein's work [E=mc2], Einstein himself did not take part in that project.

It is not essential for students to know:
Students do not need to know about the component parts of the system that Edison had to invent to provide electricity to make the light bulb practical. They don't need to know that Edison also invented a motion picture camera and started a movie production studio in New Jersey or that he applied for over

1,000 patents for his inventions. Students do not need to understand the contribution of Westinghouse to the development of alternating current that made transmission over long distances cheaper nor the role of other entrepreneurs and financiers in the creation of the electric industry. For instance, they do not need to remember the role of the African American inventor Lewis Latimer who received a patent for creating carbon filaments that made electric lighting more practical or that Alexander Graham Bell began experimenting with the transmission of sound because his mother was deaf. They don't need to know that the Wright Brothers were not the only people to experiment in flight. However, they were the first to succeed.

Students do not need to be able to explain Einstein's theory of relativity.

Although the indicator does not require that students know the life stories of these inventors; their persistence, intellectual curiosity and early difficulties in school are great examples of the impact of inquisitiveness and personal character on success.

Students so not need to remember other important inventors of the time period including George Washington Carver who was a botanist, and Ernest Just who was a cell biologist.

Assessment guidelines:
Appropriate assessments require students to **identify** these scientists and **summarize** their most important inventions. Students should also be able to **explain** how these inventors impacted the emergence of the United States as a leading world power both economically and militarily.